

To: T10 Technical Committee  
 From: Rob Elliott, HP (elliott@hp.com)  
 Date: 11 November 2002  
 Subject: 02-443r2 SAS Handling Link Rate Not Supported

### **Revision History**

Revision 0 (25 October 2002) First revision

Revision 1 (2 November 2002) Incorporated feedback from 29 October 2002 SAS protocol teleconference. Group preferred I\_T\_L\_Q storage per command, allowing updates on CONNECTION RATE NOT SUPPORTED. Group did not discuss STP connections from an STP target; the last inbound connection rate is suggested for those.

Revision 2 (11 November 2002) Incorporated feedback from 5 November SAS WG.

### **Related Documents**

sas-r02c - Serial Attached SCSI revision 2c

### **Overview**

Pak-lung Seto of Intel raised two questions on the T10 reflector about issues not addressed in sas-r02b.

1. What CONNECTION RATE (aka CONNECTION LINK RATE) does the target use in its OPENS?
2. What does a target do when it receives OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED)?

### **Suggested Changes**

1. What CONNECTION RATE should the target use in its OPEN address frames? This text is proposed:

#### **7.7.3 OPEN address frame**

Every phy shall support the 1,5 Gbps connection rate at every physical link rate.

When requesting an SSP connection to an SSP initiator port, an SSP target port shall set the CONNECTION RATE field to the connection rate in effect when the command was received unless it has received an OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED). See 7.12.2.2 for details on handling OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED).

The target port should send frames in an open connection to the initiator port regardless of whether the saved connection rate for that command matches the current connection rate; the target port should not close the connection just to reopen the connection at the saved connection rate.

When requesting an STP connection to an STP initiator port, an STP target port shall set the CONNECTION RATE field to the the last value received in a connection request from the initiator port unless the STP target port has received an OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED).

#### **7.12.2.2 Connection request responses**

After an OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED) has been received, the target port shall set the connection rate for future requests for that I\_T\_L\_Q to:

- a) the last value received in a connection request from the initiator port;
- b) 1.5 Gbps; or
- c) the connection rate in effect when the command was received.

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**Editor's Note 1:** The SAS WG asked that the following recommendation be added for STP initiators to keep the expander from introducing aggressive HOLD flow control and rate matching on its own when a 1.5 Gbps initiator talks to a 3.0 Gbps target. When sending, the expander can use HOLD every other dword. When receiving, however, the expander has to allow for 20 dword bursts at 3.0 Gbps each time it releases HOLD. If the physical link rate is 1.5 Gbps, nothing need be done.

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#### **7.15 Rate matching**

If an STP initiator port discovers an SATA target device with a physical link rate greater than the maximum connection rate supported by the pathway from the STP initiator port, the STP initiator port should use the SMP PHY CONTROL function to set the MAXIMUM PHYSICAL LINK RATE field of the phy attached to the SATA target device to the maximum connection rate supported by the pathway.

2. What does a device do when it receives OPEN\_REJECT (CONNECTION RATE NOT SUPPORTED)? This should not happen in normal operation, but could occur if there is a wide link with multiple link rates (already an unusual case) and all the fastest physical links go offline.

I suggest this rule for targets:

#### **7.12.2.2 Connection request responses**

If a target port receives an OPEN\_REJECT (LINK RATE NOT SUPPORTED) in response to one of its connection requests that has the CONNECTION RATE field set to greater than 1.5 Gbps, it shall retry the connection request with the CONNECTION RATE field set to 1.5 Gbps or the last value received in a connection request from that initiator port.

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Editor's Note 2: For initiators, an unexpected OPEN\_REJECT(LINK RATE NOT SUPPORTED) should not happen, since a CHANGE should arrive before that response arrives. However, the initiator may still see OPEN\_REJECT(LINK RATE NOT SUPPORTED) for a connection request in flight when CHANGE arrives. After new discovery, the initiator should repeat its connection request with a proper connection rate.

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#### **7.7.3 OPEN address frame**

When requesting a connection to a target port, an initiator port shall set the CONNECTION RATE field to a value supported by the pathway. For each wide link in the pathway, at least one physical link in the wide link shall support the connection rate. For each narrow link in the pathway, that physical link shall support the connection rate.